

# Unmanned Vehicle Guidance Using Video Camera/Vehicle Model

**Project Number: 97-23**

**Investigator: Tom Sutherland/EB23**

## Purpose

The purpose of this CDDF project is to improve the state-of-the-art of vehicle navigation by two methods. The first is to improve the current video guidance sensor's (VGS) capabilities by redesign of the video sensor assembly. The second goal of this effort is to develop a guidance system that is based on a single camera/modeling method.

## Background

The current VGS system uses a single camera as the imaging device. Two successive images are captured with each image scene (e.g., the target vehicle and retroreflector) being illuminated by a different frequency laser. The two images would be the same except that the retroreflectors have a filter over them that absorbs one of the laser frequencies. The different image only shows the targets and no other objects. By knowing the dimensions of the targets and their relative position, the relative positions of the camera can be computed. Due to the heavy burden of doing the image subtraction, this current configuration can only support a navigation update rate of 5 hertz.

The current VGS system requires that the target vehicle be mounted with retroreflectors (targets), and the viewing angle in which the targets can be seen is very limited. Other approaches that do not require predetermined targets or limit the range of viewing should be investigated.

## Approach

Two methods will be used to improve the current VGS.

1. Implement the image subtraction algorithm in hardware, i.e., in discrete digital devices or field programmable gate arrays to speed up the navigation update rate.
2. Determine the best algorithm/hardware system that will allow tracking and coordinate acquisition using a single camera/nontarget-based system.

## Accomplishments

The first year has been one of designing electronic hardware, selecting optical components, and doing literature searches. A TM320C40 digital signal processor (DSP) based processing card was designed to accept a daughter card. The daughter card will hold the video interface to the camera. One daughter card has already been built which takes the Wavelet transform of the image data as it is taken. Another daughter card is being completed that will take two camera inputs and do the hardware subtraction of the images before sending the data to the DSP.

Methodologies for vehicle tracking have been studied and are being incorporated into the design of the model-based vehicle tracking system. The DSP interface board has already been adapted to

work on another project as the heart of the video processor system (experimental vector magnetograph experiment).

### **Planned Future Work**

The dual-camera daughter board interface is nearly completed. The dual camera/hardware subtraction system will then be tested and compared with the current VGS system.

The model based tracking system is still in the “literature search” mode. When the best method/algorithm has been selected the DSP interface board will be the platform on which the concept will be demonstrated and verified.

<b>Funding Summary (\$k)</b>	<b>FY97</b>	<b>FY98</b>
Initial allocation:	32	13,213
Obligated:	32	5,459
Unprocessed balance:	0	7,754